

**Patent claims:**

1. A method for determining the relative position between two or more objects in a marine environment, including waterways, of which at least one object can be maneuvered relative to one or more other objects, where at least one interrogator is arranged on one or more of the objects and sends a radio wave signal to at least one transponder arranged on one or more of the other objects, **characterized** by combining the following steps:
  - using a FMCW radar in the interrogator,
  - using the transponders for bringing identity tags into the signals to be reflected to the interrogator, and
  - using attitude determination.
2. A method according to claim 1, **characterized** by the following steps:
  - that at least one interrogator sends a radio signal to at least one transponder arranged on an object for relative positioning,
  - that one or more transponders modulates an identifier frequency into the signal from the interrogator prior to the signal being reflected to the interrogator,
  - that the signals from the transponders are received by a series of antenna elements in the interrogator,
  - that the combination of the signals received on different antenna elements is used to determine the angles to the transponders in two planes relative to the antenna elements geometry, and
  - that the signals from the transponders are processed to determine the beat frequencies and the Doppler frequencies for each transponder, and
  - that this is used for determining the distance and the relative velocity between the interrogator and each of the transponders, which from the frequency of the carrier signal, can determine the identity of the signal and on this basis determine the position data.
3. Method according to claim 2, **characterized** in that one or more interrogators are simultaneously interrogating multiple transponders.
4. Method according to claim 2 or 3, **characterized** in that an interrogator is operated autonomously towards any transponder.
5. Method according to claim 3 or 4, **characterized** in that the interrogator illuminates all the transponders simultaneously.

6. Method according to any one of claims 2-5, **characterized** by combining the distance and angles in two planes, for positioning of one or more transponders in 3 dimensions.

7. Method according to any one of claims 2 -6, **characterized** in combining the relative 5 distance and angles with attitude determination systems, to provide an absolute determination of transponders or interrogators.

8. Method according to any one of claims 2-7, **characterized** in that a fixed transponder at the same object as the interrogator, is used for continuous self calibration and integrity monitoring.

10

9. Method according to any one of claims 2-8, **characterized** in that a differential positioning between two or more transponders is carried out.

10. Method according to any one of claims 2 – 9, **characterized** in that a position determination 15 of the interrogator from ranges is obtained, when the relative or absolute position of the transponders is known.

11. System for carrying out the method of claim 1, for determining the relative position between two or more objects (10, 12) in a marine environment, including waterways, of which at least one 20 object (10) can be maneuvered relative to one or more other objects (12), where at least one interrogator (20) is arranged on one of the objects (10) and provided to transmit a radio wave signal to at least one transponder (Tr) arranged on one or more of the other objects (12), **characterized** by comprising following elements:

25 - a FMCW radar in the at least one interrogator (12) and  
- at least one transponder (Tr) is provided to generate a different sideband frequency to introduce an identity tag into a signal to be reflected to the interrogator, and  
- a signal processing unit with software containing algorithms for determination of ranges, velocities and angles to transponders.

30 12. System according to claim 11, **characterized** in that the interrogator (20) is implemented with non-moving elements.

13. System according to claim 11 or 12, **characterized** in that a fixed transponder is provided on the same object as the interrogator, for continuous self calibration and integrity monitoring.